



EMISSIONS TRADING & CARBON FOOTPRINTS: A NEED FOR A COMMON ACCOUNTING APPROACH

Robin Huttenbach, CEng MChemE
Study Manager, KBR-Granherne Ltd, Moscow

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Emissions Trading & Carbon Footprints : A Need for a Common Accounting Approach

NB: the Carbon Trust has published more information on the derivation of carbon footprints since this presentation was prepared. The term now seems to address emissions (direct and indirect) rather than the embodied carbon / energy content of the assets used by organisations. This requires further clarification.

The opinions expressed in this presentation are those of the author.
For additional material, please consult the following blog:
http://www.petrolog.typepad.com/climate_change/

Emissions Trading & Carbon Footprints :

Outline of the Presentation

- Introduction
- The Accounting Conundrum
- The Market Economy and Use of Natural Resources
- Assigning a Monetary Value to Carbon
- The Historical and Predicted Price of Carbon
- Issues with Emissions Trading
- Carbon Risk and Potential Liabilities
- Some Suggestions for Investment Decisions
- Conclusions

Emissions Trading & Carbon Footprints : Introduction (I)

- The use of markets to regulate the emissions of carbon dioxide (and ultimately other greenhouse gases) has attracted much interest in recent years.
- This presentation:
- Examines the accounting conundrum and outlines the need for a new approach that would value both the emissions and the embodied carbon content - the so-called carbon footprint - of the underlying asset.
- Describes how a monetary value has been assigned to carbon in the past and what the price of this new asset class might be in the future.
- Reviews some of the limitations of emissions trading.

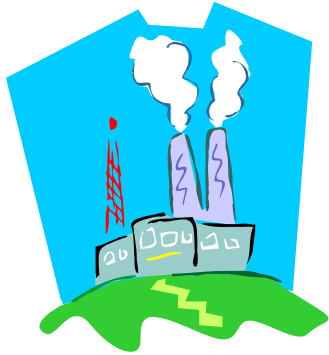
Emissions Trading & Carbon Footprints : Introduction (II)

- Considers the difference between :
 - the market approach → emissions trading
 - the engineering approach → life cycle costing.
- Presents a definition of carbon risk and highlights the potential liabilities companies face if they fail to assess such risk.
- Closes with some suggestions for discount rates and the price of carbon that investment decision makers might use. These should be reviewed by industry and a consensus reached to help incentivise the development of technologies that would reduce carbon footprints.

Emissions Trading & Carbon Footprints : A Need for a Common Accounting Approach

THE ACCOUNTING CONUNDRUM

Emissions Trading & Carbon Footprints : The Accounting Conundrum (I)

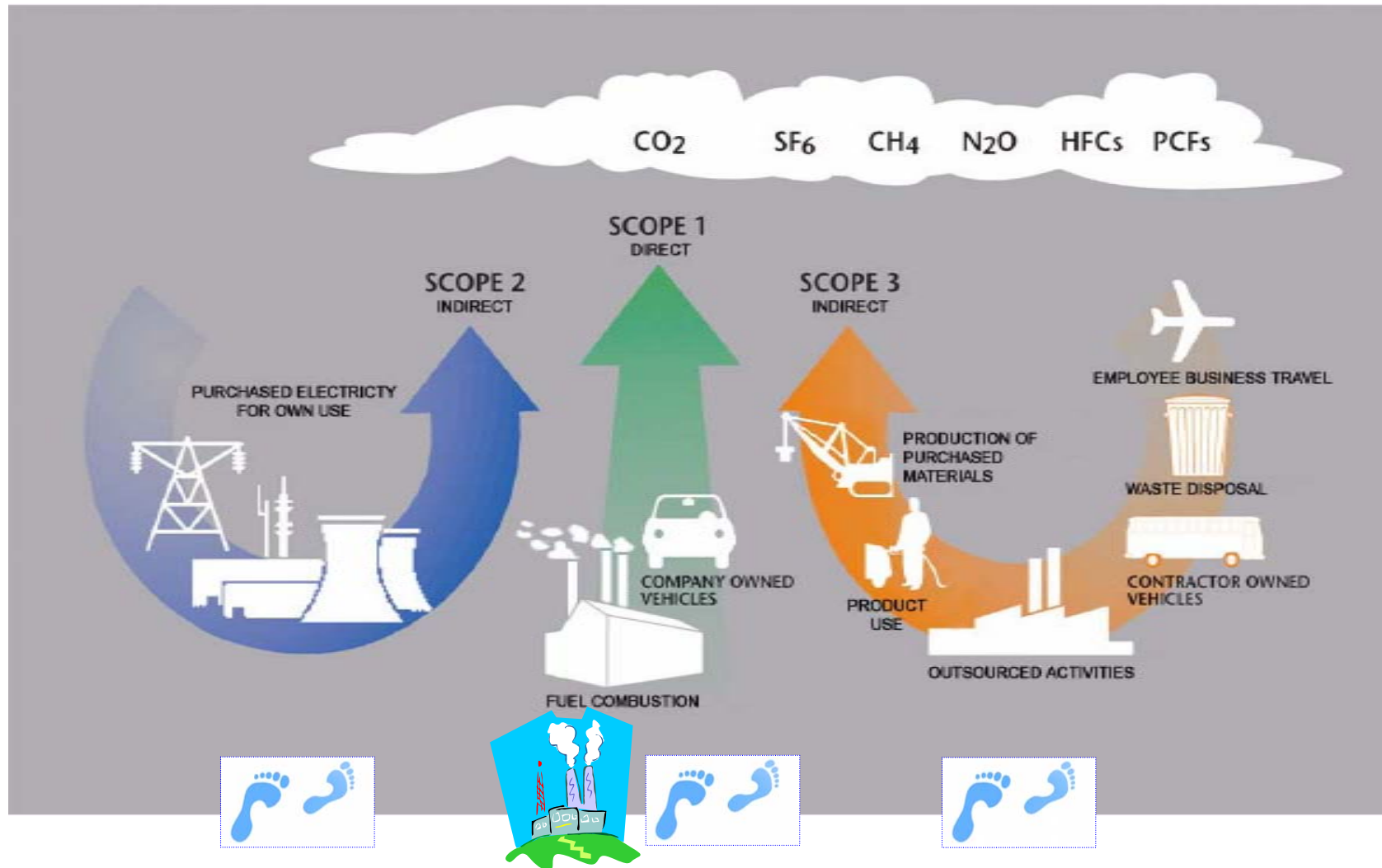


Emissions : Values the 'direct' carbon content as an intangible asset or a contingent liability. Trading is concerned with the impact this can have on the profit and loss account.



Carbon Footprints : Assigns a value to the underlying asset in terms of its embodied carbon or energy content. The value of the 'direct' and 'indirect' carbon consumed is presently not assigned a book value in the financial accounts of organisations.

Emissions Trading & Carbon Footprints : The GHG Protocol : Reporting of Emissions



Source : GHG Accounting and RECs : A Marketer's Perspective

<http://www.eere.energy.gov/greenpower/conference/11remc06/krembs.pdf>

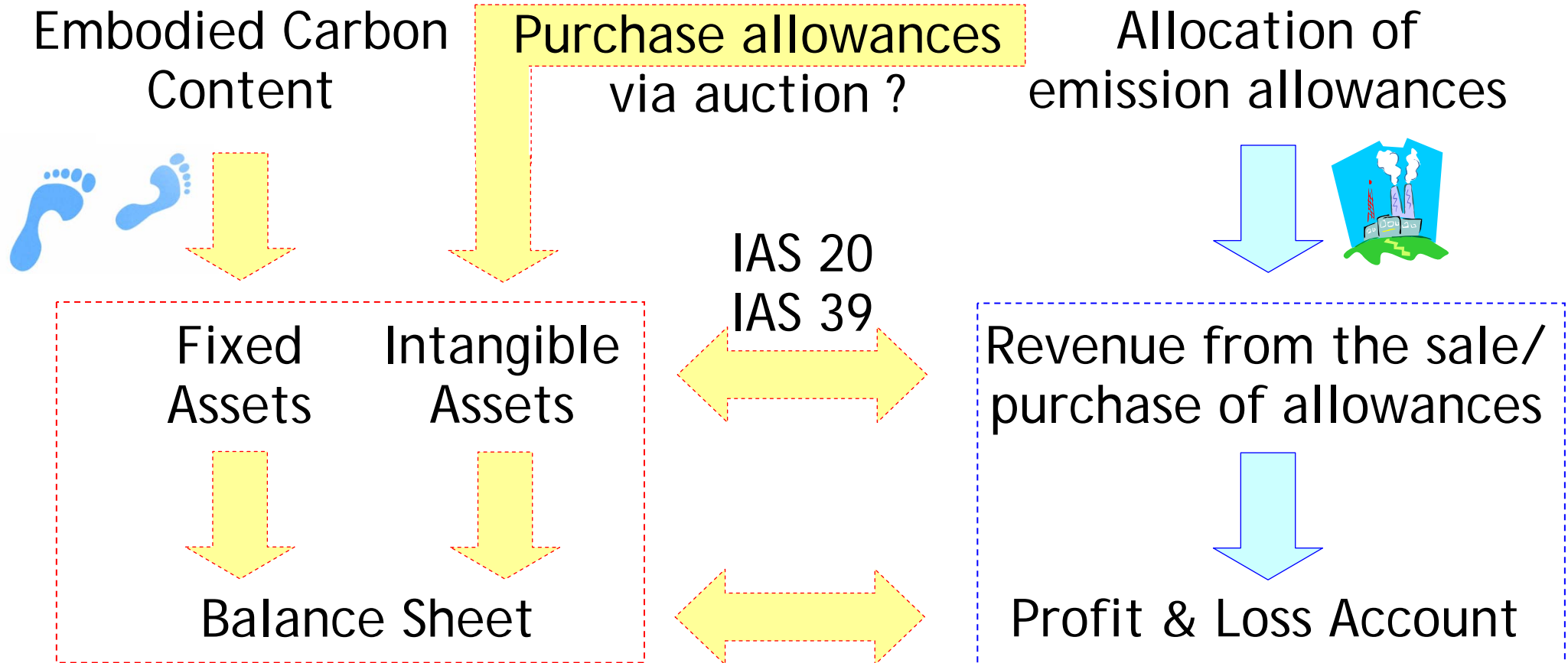
Emissions Trading & Carbon Footprints : The Accounting Conundrum (II)

- The main accounting guidelines for greenhouse gases : (<http://www.ghgprotocol.org/standards>) address operating emissions but do not consider the fact that carbon dioxide is now traded as an intangible asset or that it could be embodied in the content of an asset itself.
- Such an approach works for those trading in the emissions of carbon dioxide, but does not help an engineer attempting to use life cycle costing to compare the carbon footprint of different processes.
- In this respect, an engineer using physical units of accounts would want to consider the carbon dioxide released in the manufacture and supply of a product to determine its embodied carbon or energy content.

Emissions Trading & Carbon Footprints : The Accounting Conundrum (III)

- Businesses that rely on financial units of accounts to prepare balance sheets, commonly have no requirement in law to consider indirect emissions because these are owned and controlled by other entities.
- In this case, the value of the asset or its liability arises solely from the risk that the direct emissions of carbon dioxide pose to the income stream, e.g. see IFRIC 3 - now withdrawn : (<http://www.iasplus.com/interps/ifric003.htm#withdraw>), IAS 20 (<http://www.iasplus.com/standard/ias20.htm>) which was to be updated to include the trading of green house gas allowances as granted by governments. Also, see IAS 39.
- How then to modify accounting procedures to take account of the carbon content of an asset ?

Emissions Trading & Carbon Footprints : The Accounting Conundrum (IV)



How to write down/depreciate
the carbon content of an asset
via the P&L account ?

Emissions Trading & Carbon Footprints : The Accounting Conundrum (V)

- What implication would the write down / depreciation of assets as accounted for in terms of their carbon content have for the tax system ?
- Is it possible to reconcile the difference between accounts based on money and those that record the utilisation of a (non-monetary) resource ?
- Environmental accounting procedures are complex and do not appear suitable for the task in hand. Documents such as the UN's Environmental Management Accounting: <http://www.un.org/esa/sustdev/publications/publications.htm#technology> attempt to map monetary values via material flows.

Emissions Trading & Carbon Footprints : The Accounting Conundrum (VI)

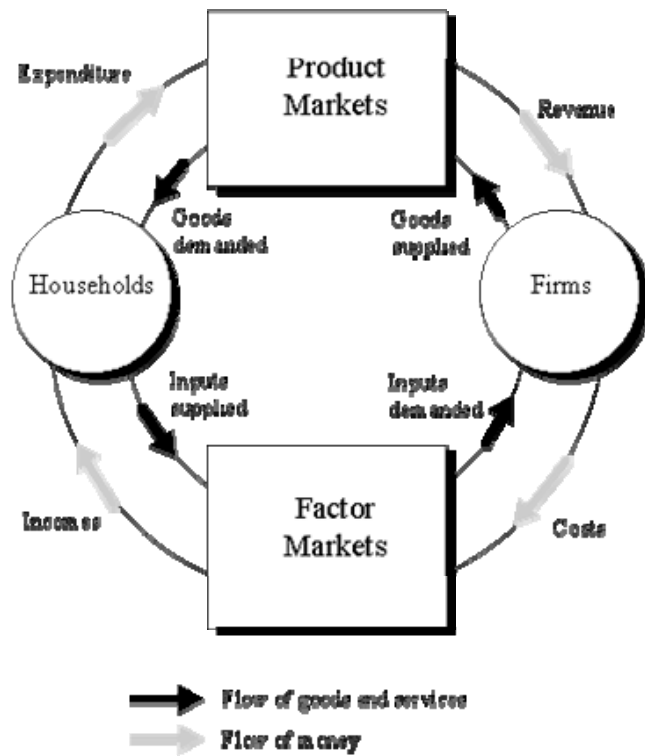
- A further point :
- 'Carbon neutrality' and the use of offsets is a misnomer. They consider operating emissions, but not the embodied carbon content of the assets that organisations need to conduct their business. In this respect, it will probably be easier for a company in the service sector to claim it is 'carbon neutral' than a company that manufactures goods.

Emissions Trading & Carbon Footprints : A Need for a Common Accounting Approach

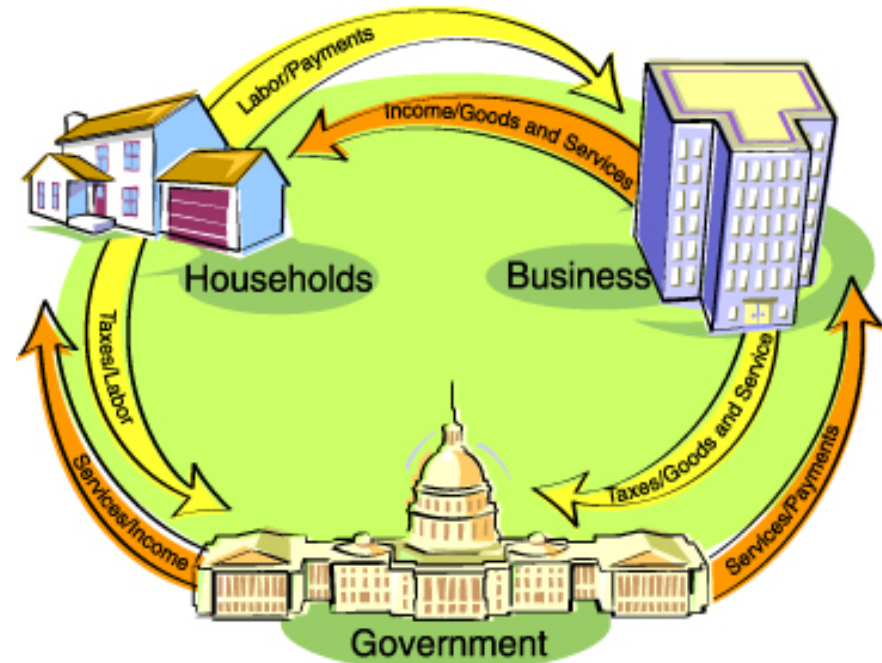
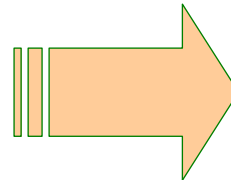
THE MARKET ECONOMY AND USE OF NATURAL RESOURCES

Emissions Trading & Carbon Footprints : The Market Economy and Use of Natural Resources

Producer and consumer decisions in a market economy are determined primarily by the forces of supply and demand. Governments play a role in this market - for example, taxing externalities to ensure pollutants such as carbon dioxide have a value.

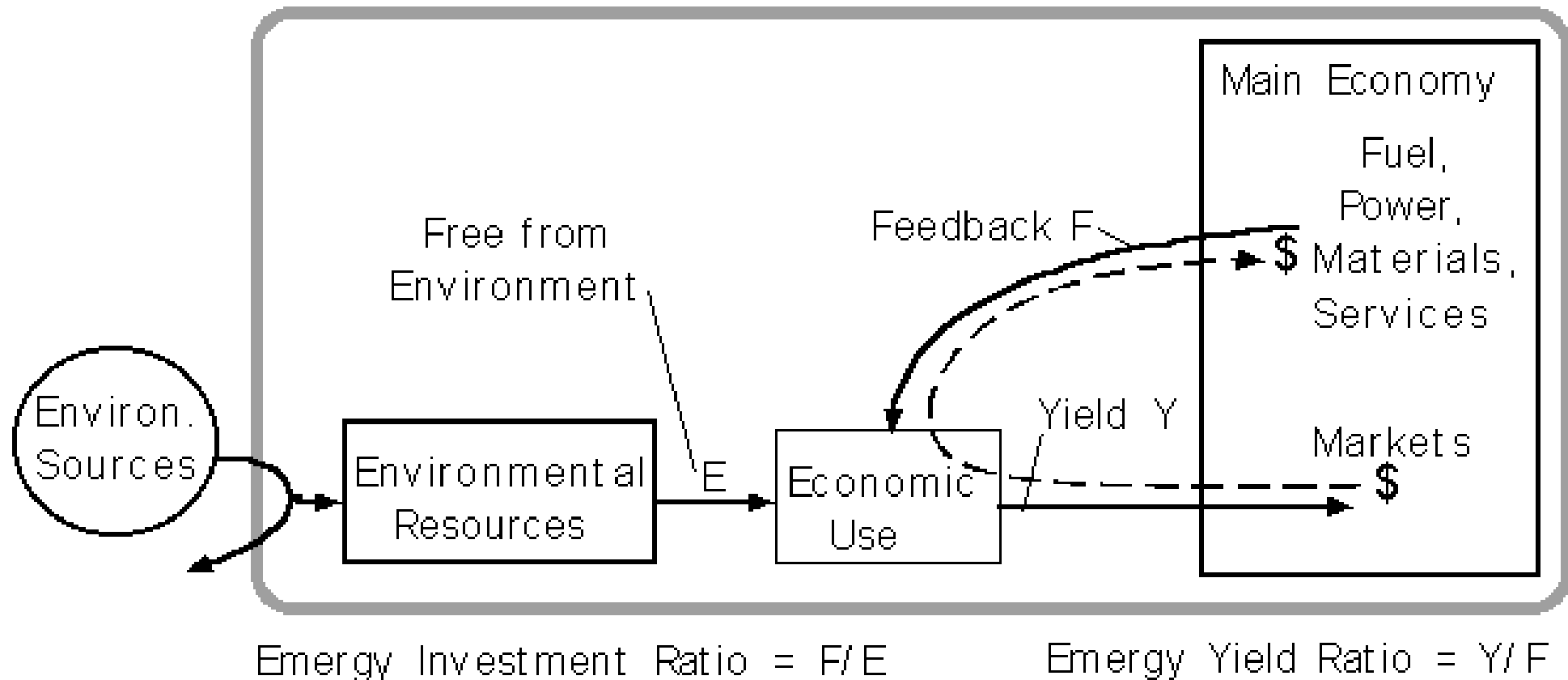


Classic Model



The Role of Government

Emissions Trading & Carbon Footprints : Alternative Models of the Economy



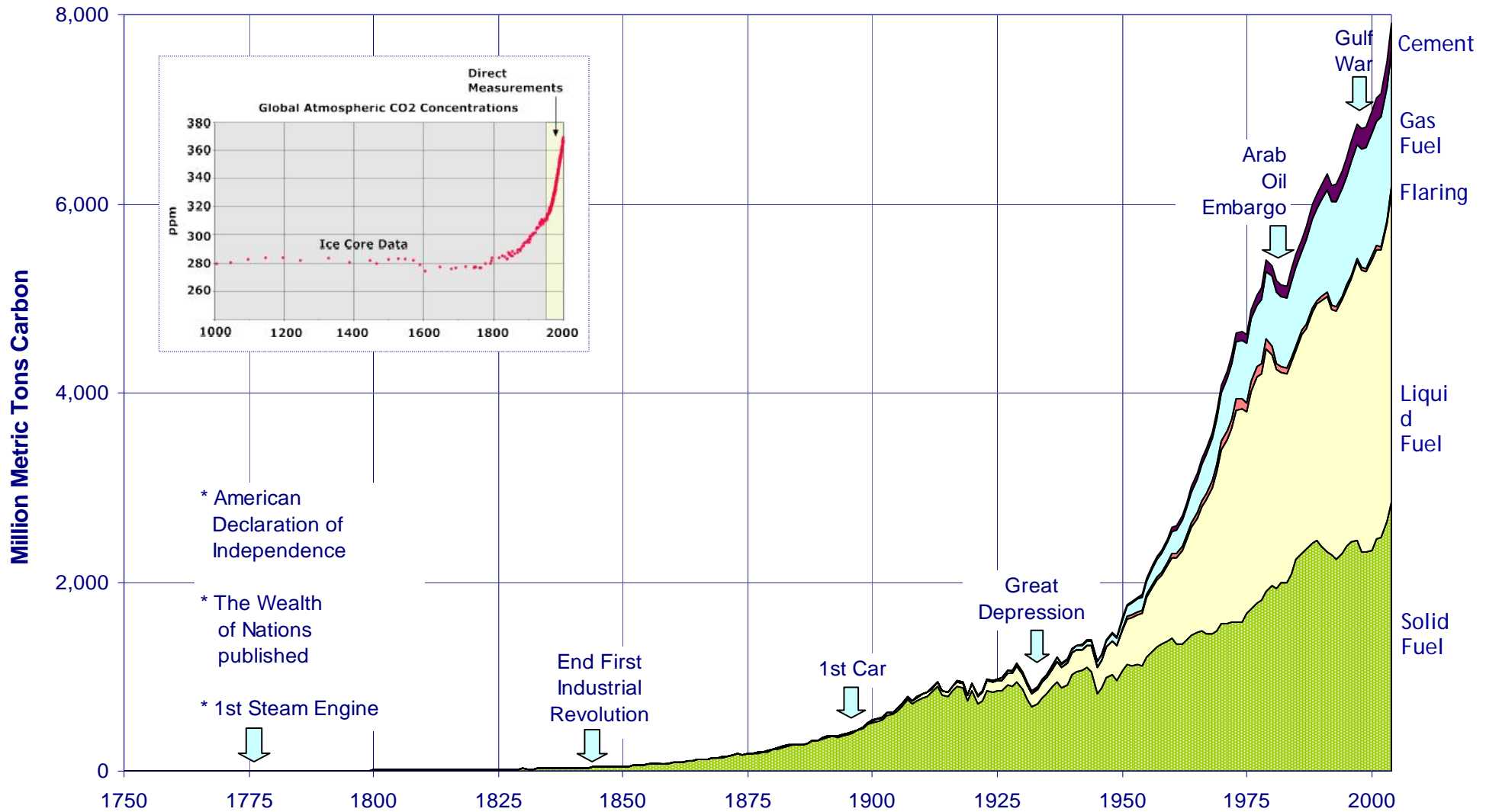
Source : Odum, H.T. 1996. Environmental Accounting, Energy and Environmental Decision Making, John Wiley, NY, 370 pp <http://www.amazon.com/Environmental-Accounting-Energy-Decision-Making/dp/0471114421>

Emissions Trading & Carbon Footprints :

The Market Economy and Use of Natural Resources

- The market economy, its associated capital markets and models of cost accounting do not assign a value to the consumption of natural resources.
- The origins of this situation are historical and arise from the development of economic theory and financial tools at a time when human activity was neither energy or resource constrained.
- The magnitude of economic activity in the 21st century and the associated consumption of resources (particularly hydrocarbon fuels) now appears to be having a significant impact on the planet's natural cycles. Accounting methods should be changed to take account of this.

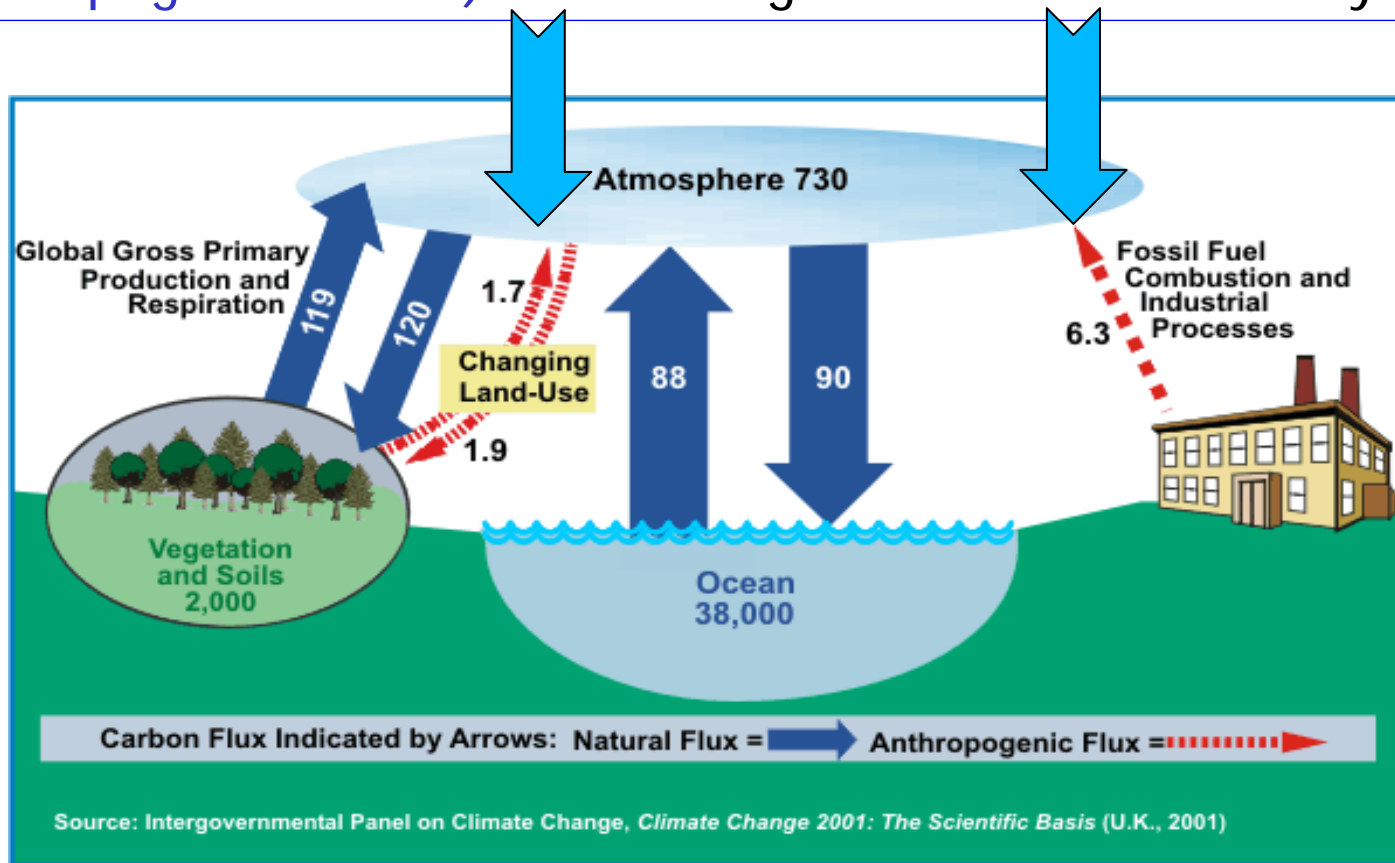
Global Emissions of Carbon Dioxide : Combustion of Fossil Fuels & Production of Cement : 1751-2004



Source : Carbon Dioxide Information Analysis Center, Oak Ridge National Laboratory <http://cdiac.ornl.gov>

Emissions Trading & Carbon Footprints : The Global Carbon Cycle

The concern is that the increase in atmospheric carbon dioxide levels caused by the burning of fossil fuels and changes in land use (so called anthropogenic fluxes) is affecting the natural carbon cycle.



Flows in billions of metric tonnes per annum. Source : Carbon Cycle Science, <http://www.esrl.noaa.gov/research/themes/carbon/> US NOAA Research, Earth System Research Laboratory

Emissions Trading & Carbon Footprints : A Need for a Common Accounting Approach

ASSIGNING A MONETARY VALUE TO CARBON

Emissions Trading & Carbon Footprints :

Assigning a Monetary Value to Carbon (I)

- A market based solution requires a price be placed on pollutants that otherwise would have no value.
- The traditional approach is for governments to levy a tax on hydrocarbon fuels and demand side activities that generate carbon dioxide or associated greenhouse gases.
- 'Carbon taxes' are used widely in Europe.
- Many nations continue to subsidise the cost of hydrocarbon developments or the price consumers pay for their fuel.
- Recent initiatives aim to assign a value to carbon via a cap and trade mechanism, e.g. the European Union's emissions trading system (EU ETS). This also uses offsets, such as the Kyoto clean development mechanism (CDM).

Emissions Trading & Carbon Footprints :

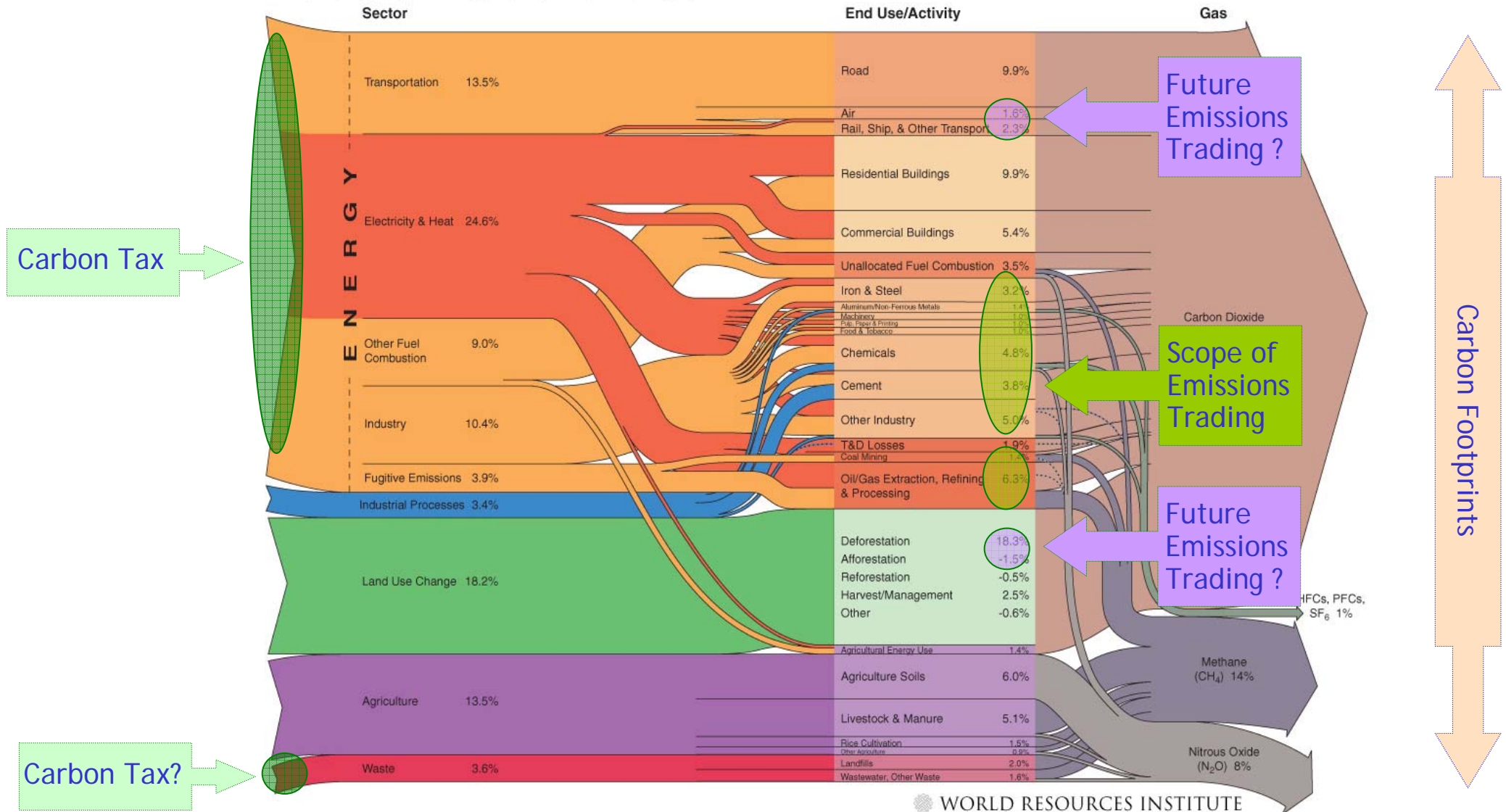
Assigning a Monetary Value to Carbon (II)

- The carbon footprint initiative attempts to quantify the carbon content of a process or product at the point of consumption. Is it feasible / desirable to assign a value to carbon at this point?
- A high price for carbon may be more acceptable politically if demand is relatively 'inelastic'. This has commonly been the case with consumers for a tax on fuel (see subsequent slides) but will be more difficult to promote with corporations operating in competitive markets.
- GHG producing activities to be covered by taxes and /or trading schemes are becoming increasingly complex. New areas under consideration include: aviation and marine transport, motor vehicles, forestry and agriculture.

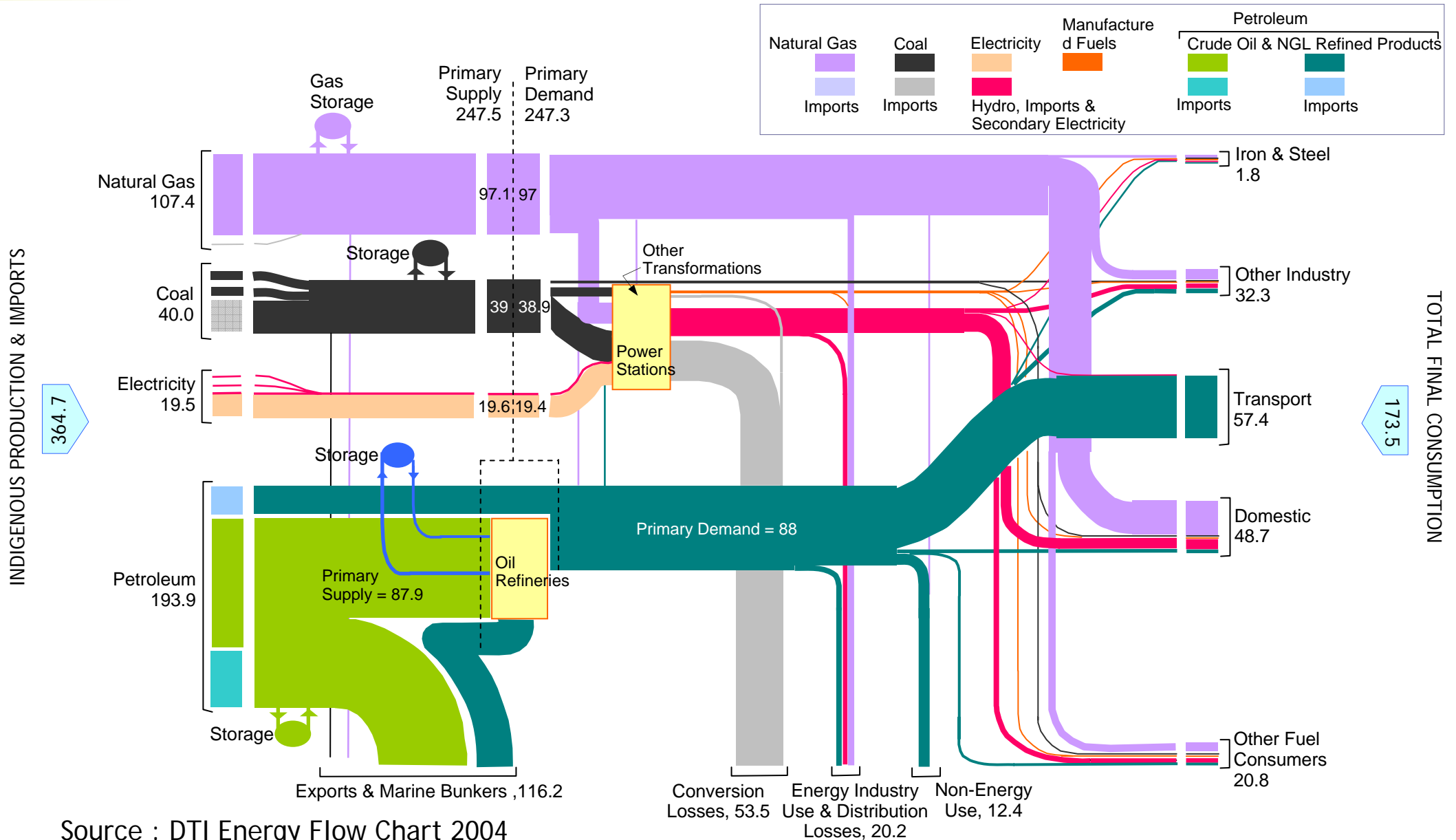
Emissions Trading & Carbon Footprints : World GHG Emissions Flow Chart - Carbon Dioxide Equivalents (2000)

Source : World Resources Institute, Climate Analysis Indicator Tool (CAIT)

<http://cait.wri.org/figures.php?page=/World-FlowChart>



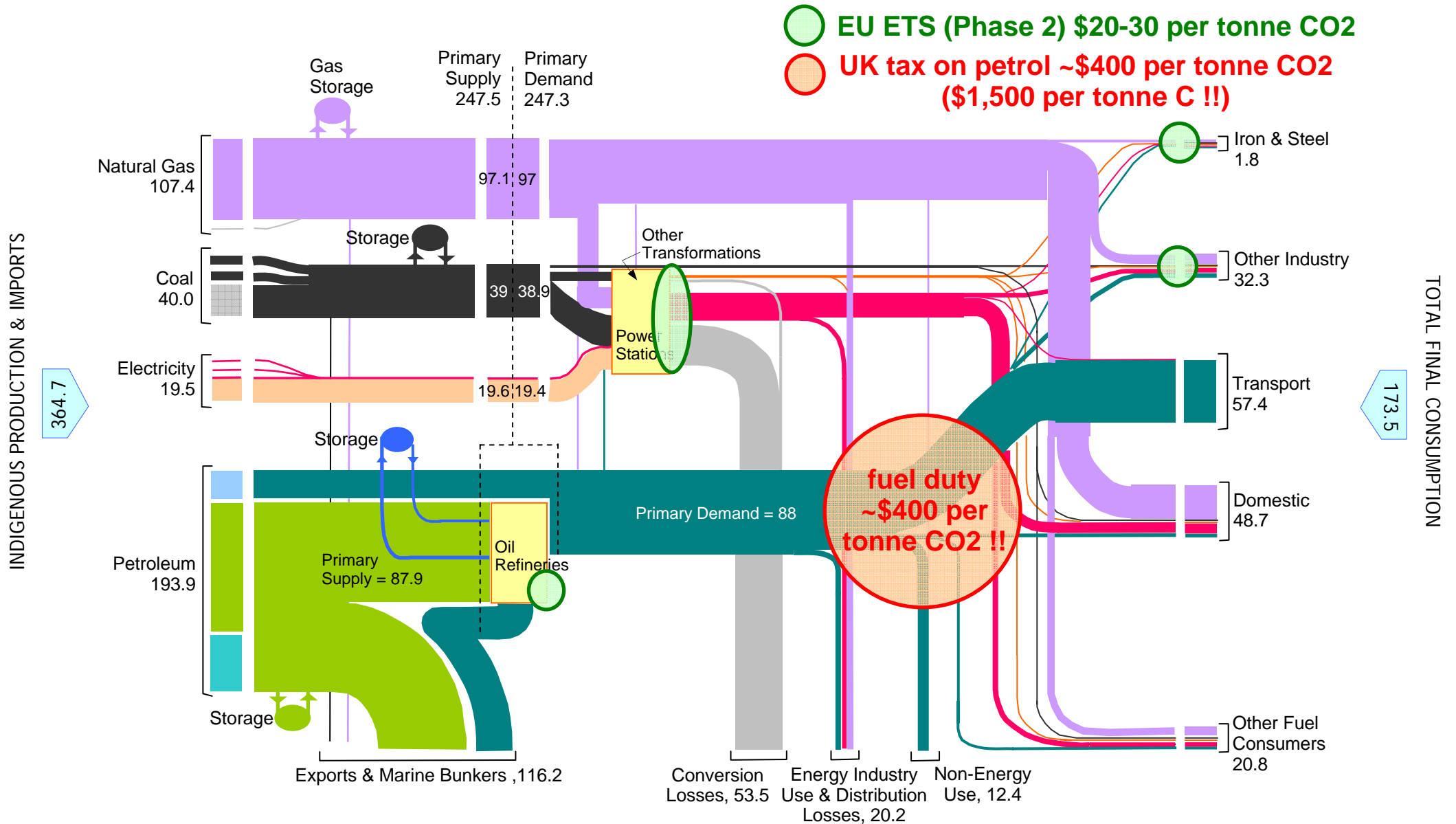
Emissions Trading & Carbon Footprints : UK Energy Flows - 2004 (million tonnes of oil equivalent)



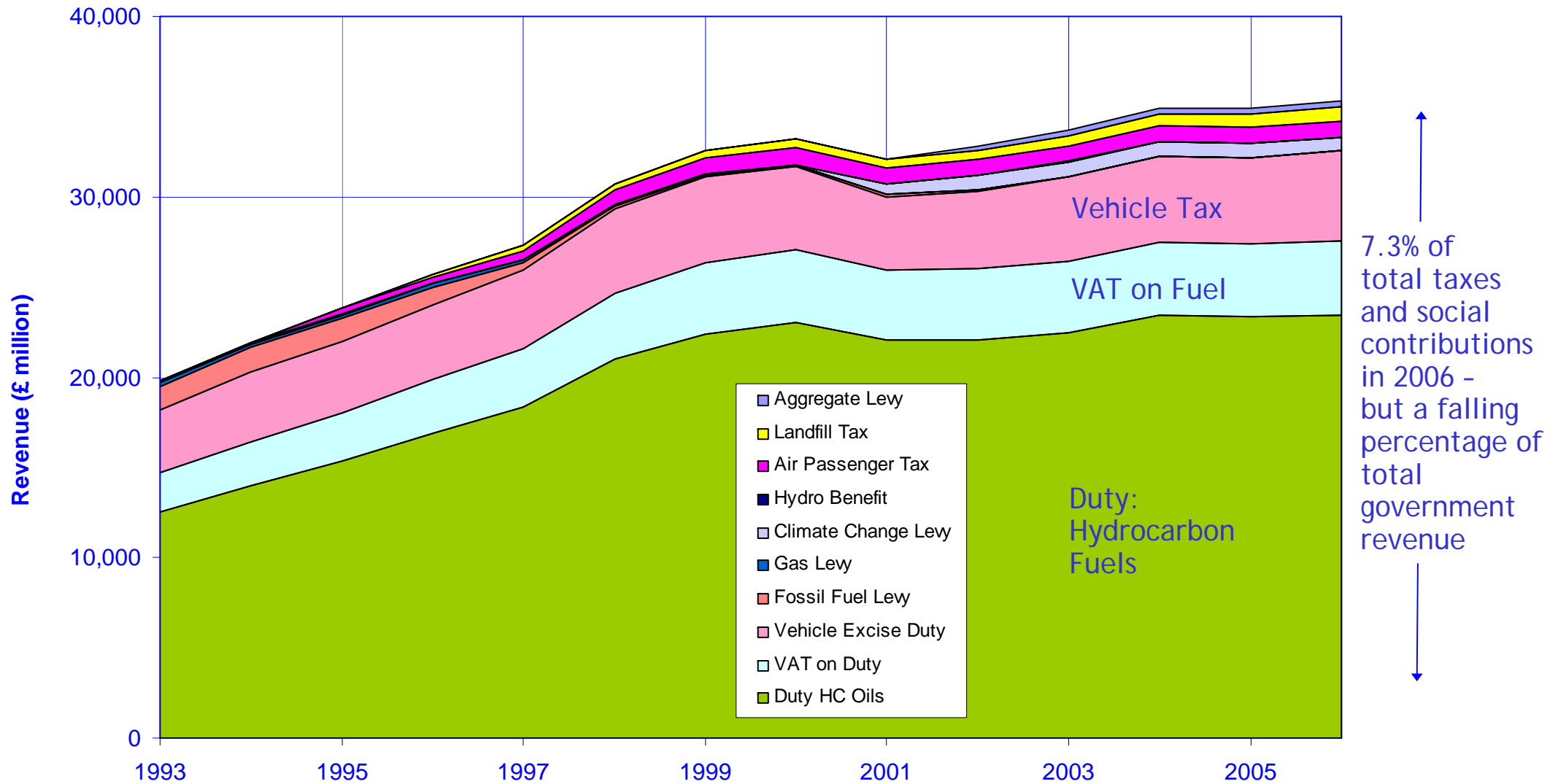
Source : DTI Energy Flow Chart 2004

<http://www.dti.gov.uk/energy/statistics/publications/flowchart/page37716.html>

Emissions Trading & Carbon Footprints : UK Energy Flows - A Carbon Tax on Hydrocarbons Already !



Emissions Trading & Carbon Footprints : UK Environmental Taxes



Source: Table 13.7, UK Blue Book, 2007, <http://www.statistics.gov.uk/statbase/Product.asp?vlnk=1143>

Emissions Trading & Carbon Footprints :

Examples of Energy Taxes in 2000 (\$PPP/tonne C)

Country	Petrol/Gasoline Unleaded	Diesel	Diesel/Gas Oil (Industrial Use)	Coal (Industrial Use)	Natural Gas (Industrial Use)
Denmark	601	348	264	246	55
France	898	473	99	0	4
Germany	751	400	51	0	62
Holland	887	429	132	18	106
Norway	792	513	59	70	180
UK	957	821	51	0	0
USA	154	147	na	na	na
Japan	488	158	4	na	44

PPP = Purchasing power parity. NB: UK fuel duty in 2007 has risen to approx \$1,500 tonne C !!

Source: A Review of Carbon and Energy Taxes in the EU : Baranzini, Goldenberg and Speck, 2000

<http://www.rec.org/REC/Programs/SofialInitiatives/Ecolnstruments/GreenBudget/GreenBudget6/carbon.html>

THE HISTORICAL AND PREDICTED PRICE OF CARBON

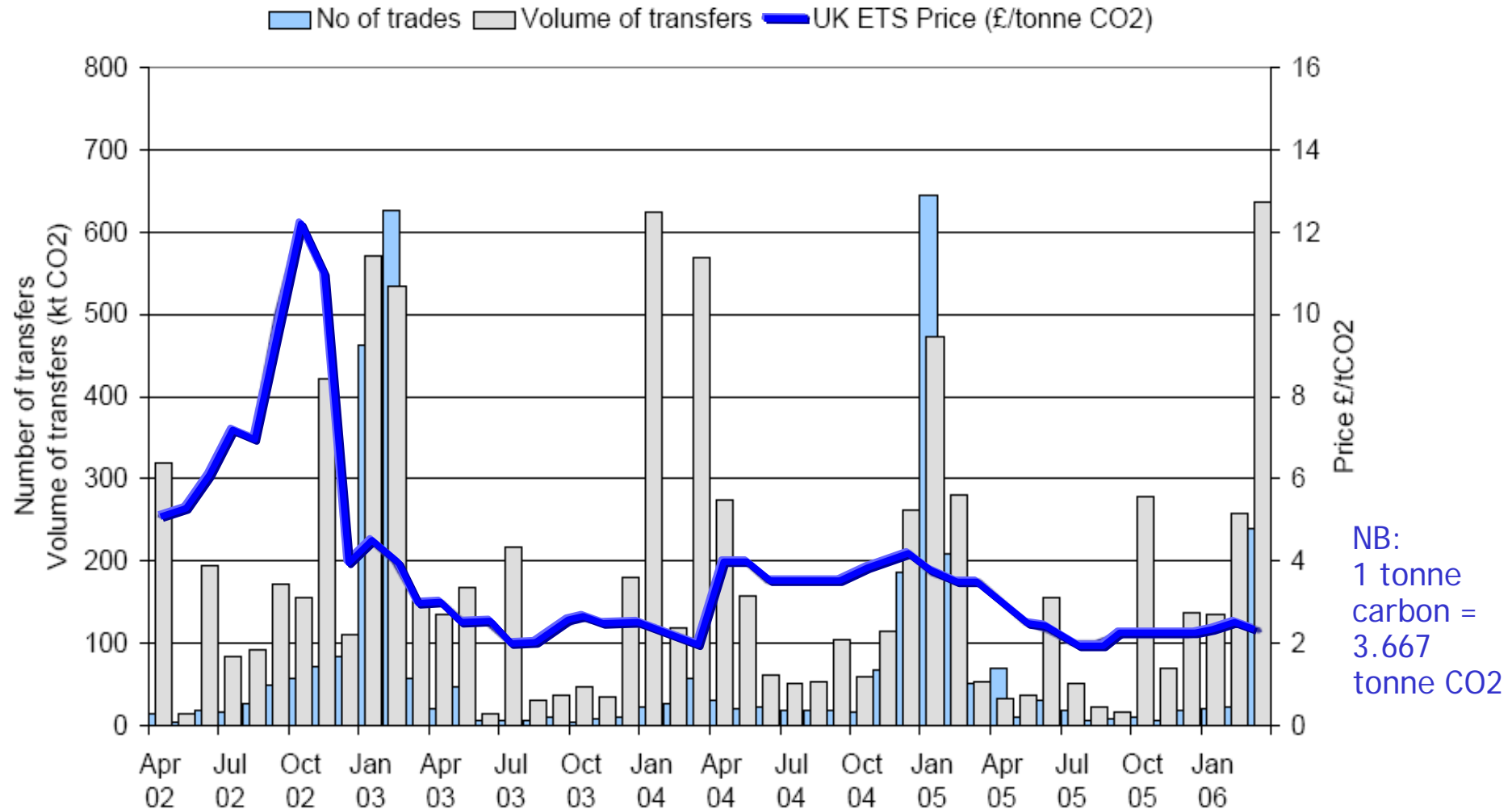
Emissions Trading & Carbon Footprints :

The Historical and Future Price of Carbon

- Price of carbon first set by UK emissions trading scheme. Price rose to ~€65 per tonne in 2002, but then declined steadily to less than €10 per tonne (€3/t CO₂).
- Phase 1 of EU emissions trading scheme began in 2005. Prices rose to €110 per tonne of carbon (€30/t CO₂) then collapsed in April 2006 once it was recognised that too many allowances had been issued.
- Phase 2 of EU ETS begins 2008. Early prices currently trading at some €55→75 per tonne carbon.
- Modelling by economists suggests the market price of allowances need only rise slowly until 2020.

NB: 1 tonne carbon = 3.667 (44/12) tonne carbon dioxide

Emissions Trading & Carbon Footprints : UK Emissions Trading Scheme, Pricing 2002→2006

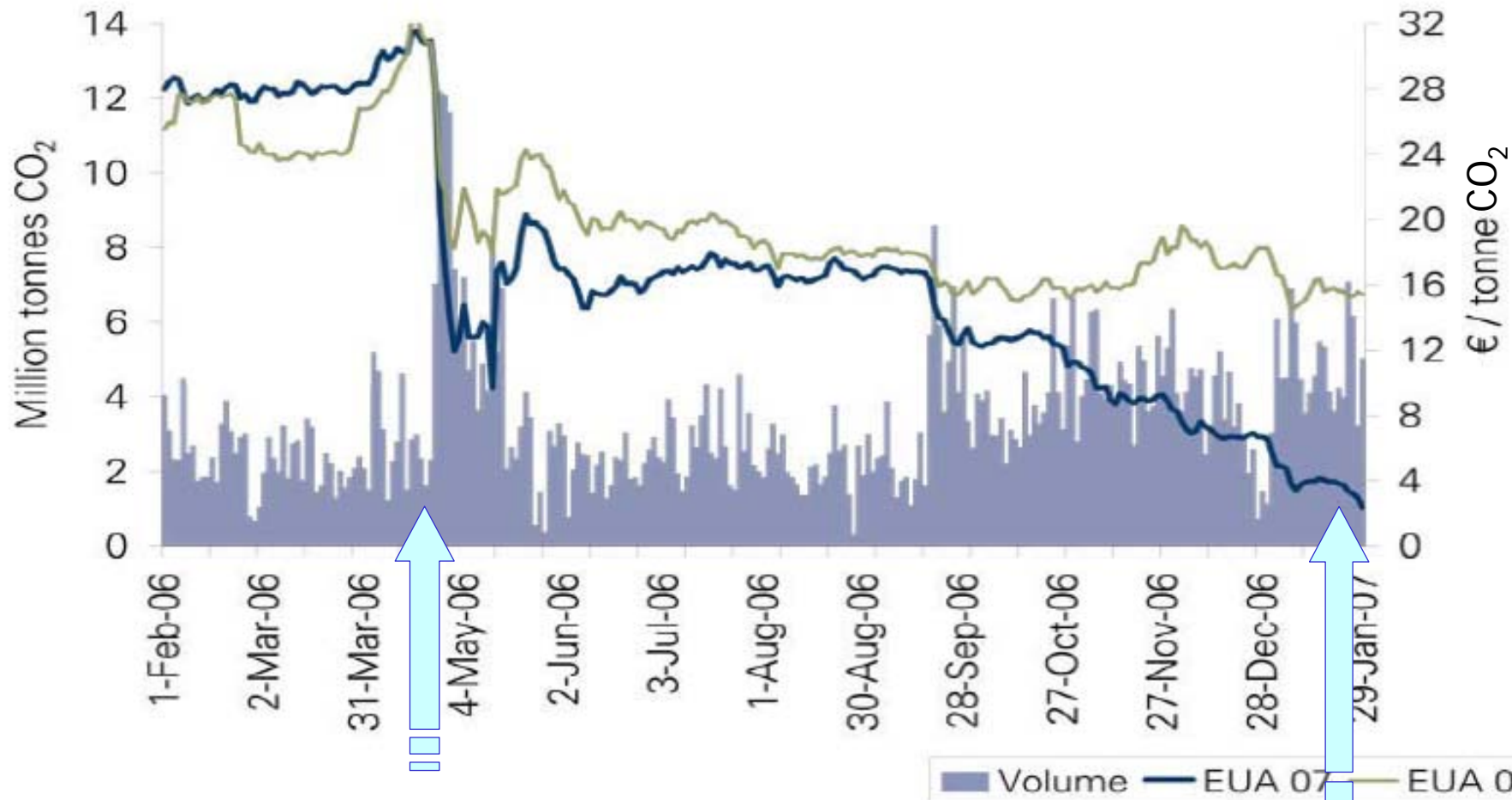


Source : Appraisal of Years 1-4 of the UK Emissions Trading Scheme, DEFRA, December 2006
<http://www.defra.gov.uk/environment/climatechange/trading/uk/pdf/ukets1-4yr-appraisal.pdf>

Emissions Trading & Carbon Footprints : EU Emissions Trading Scheme, Pricing 2005→2007

Daily volumes and prices

Daily prices for 07- and 08-contracts, as reported by Point Carbon together with daily volumes in the OTC and exchanged markets



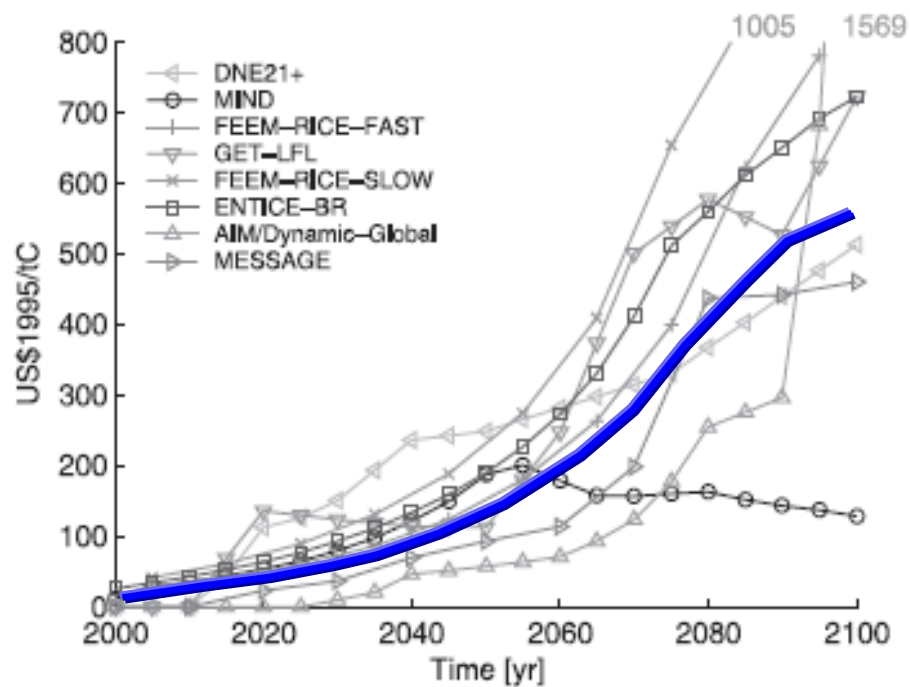
PointCarbon

Price of allowances collapsed in April 2006 once results of emissions for 2005 were published

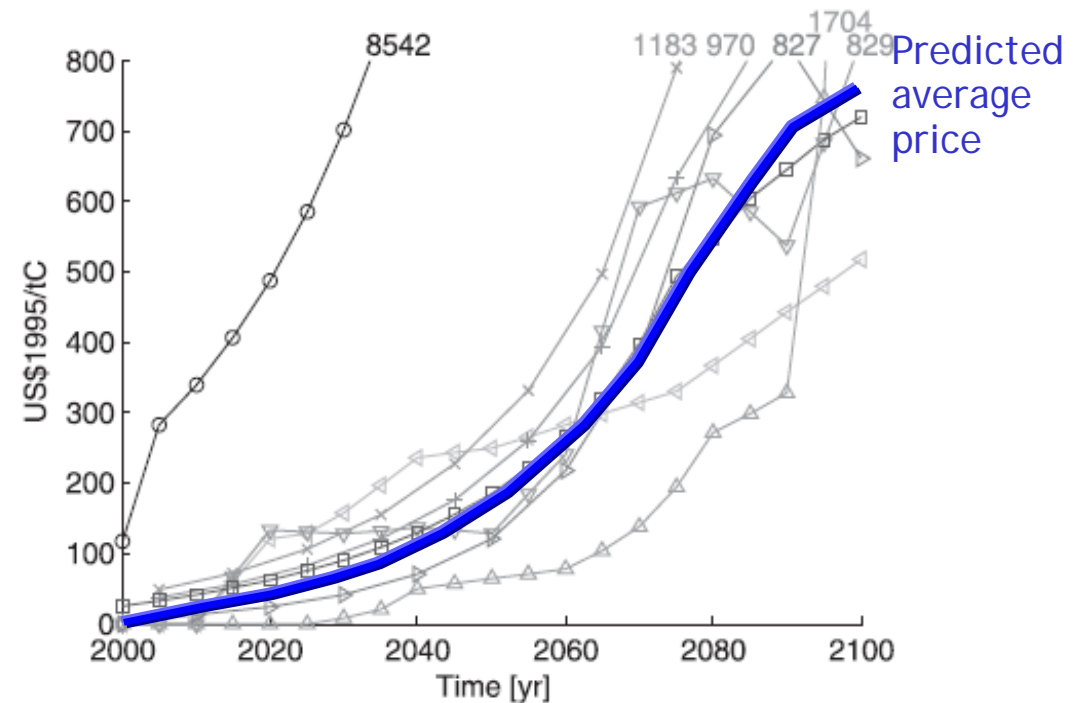
Phase I allowances non-transferrable to Phase II

Emissions Trading & Carbon Footprints : Market Modelling - Predicted Price of Carbon Dioxide Permits

With technological change
(carbon dioxide limit = 450 ppm)



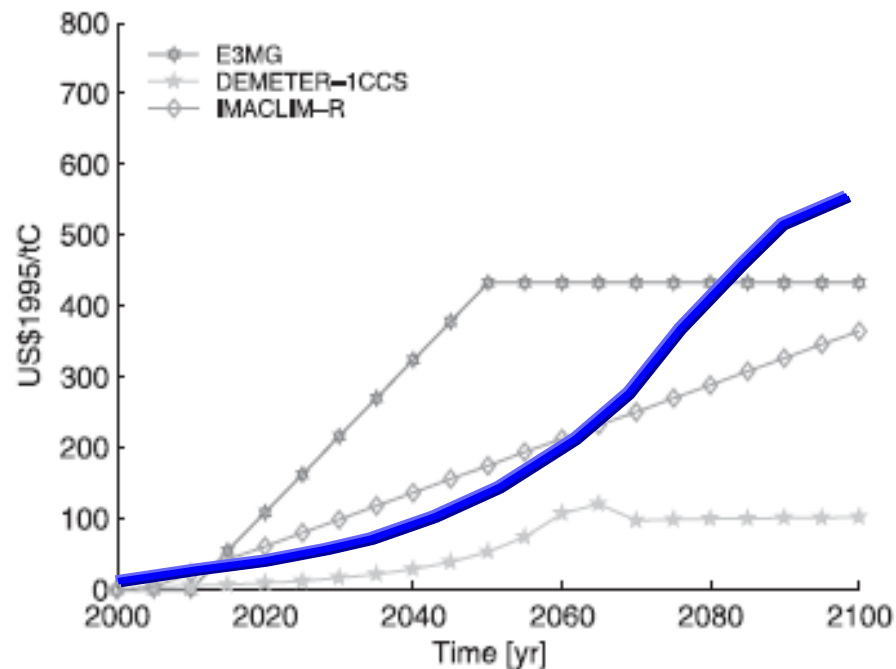
Without technological change
(carbon dioxide limit = 450 ppm)



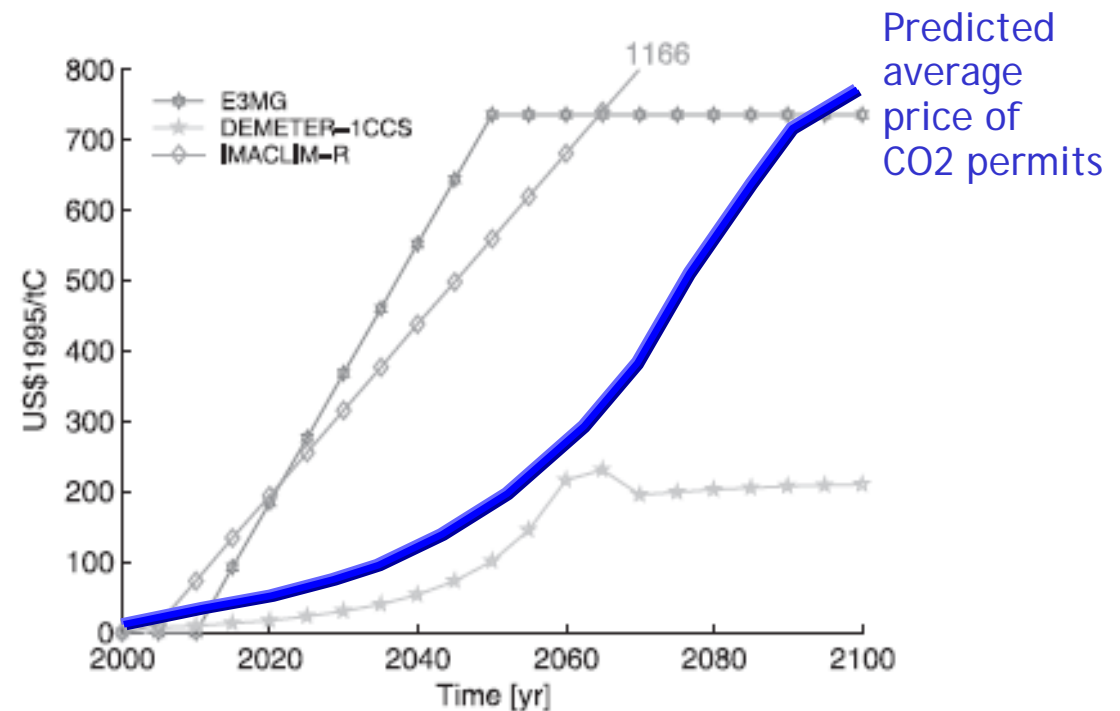
Source : Induced Technological Change: Exploring its Implications for the Economics of Atmospheric Stabilization. Edenhofer, et al. The Energy Journal, March 2006 <http://www.econ.cam.ac.uk/research/imcp/>

Emissions Trading & Carbon Footprints : Market Modelling - Predictions of an Imposed Carbon Tax

With technological change
(carbon dioxide limit = 450 ppm)



Without technological change
(carbon dioxide limit = 450 ppm)



Source : Induced Technological Change: Exploring its Implications for the Economics of Atmospheric Stabilization. Edenhofer, et al. The Energy Journal, March 2006 <http://www.econ.cam.ac.uk/research/imcp/>

Emissions Trading & Carbon Footprints : Influence of Discount Rate on the Predicted Price of Carbon

- The surprising (and somewhat perverse) result of modelling by economists is that the market price of carbon does not need to rise much above \$50 a tonne until 2020. The price in future years needs to be significantly higher if a generous discount rate (say 6-7%) is used to define the transfer of wealth between generations.
- Essentially, our children will find it easier to pay for the increased price of carbon (and environmental damage) than us!
- The Stern review proposes a much lower discount rate (2→3%) for the inter-generational transfer of wealth. This means that we would need to pay a much higher price for carbon, typically \$300→500 a tonne by 2020.

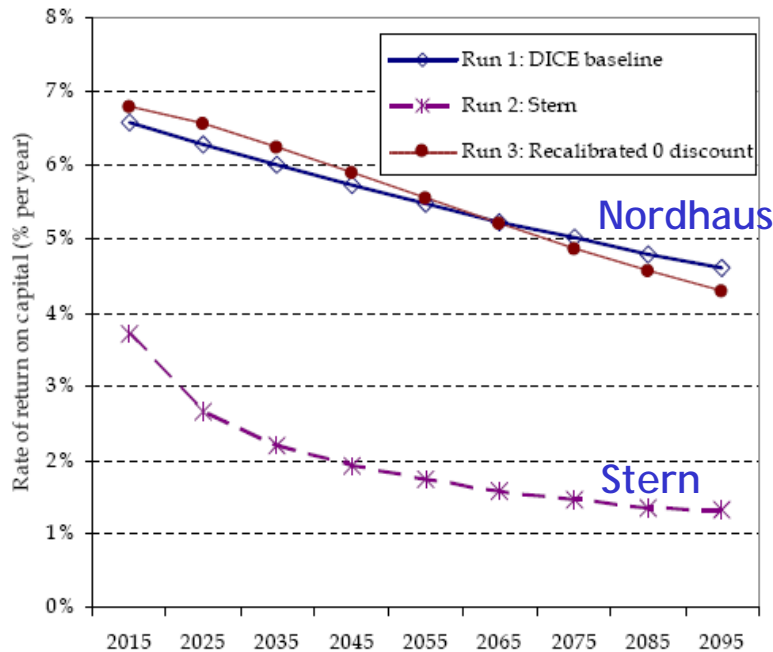
Emissions Trading & Carbon Footprints :

Influence of Discount Rate on the Predicted Price of Carbon

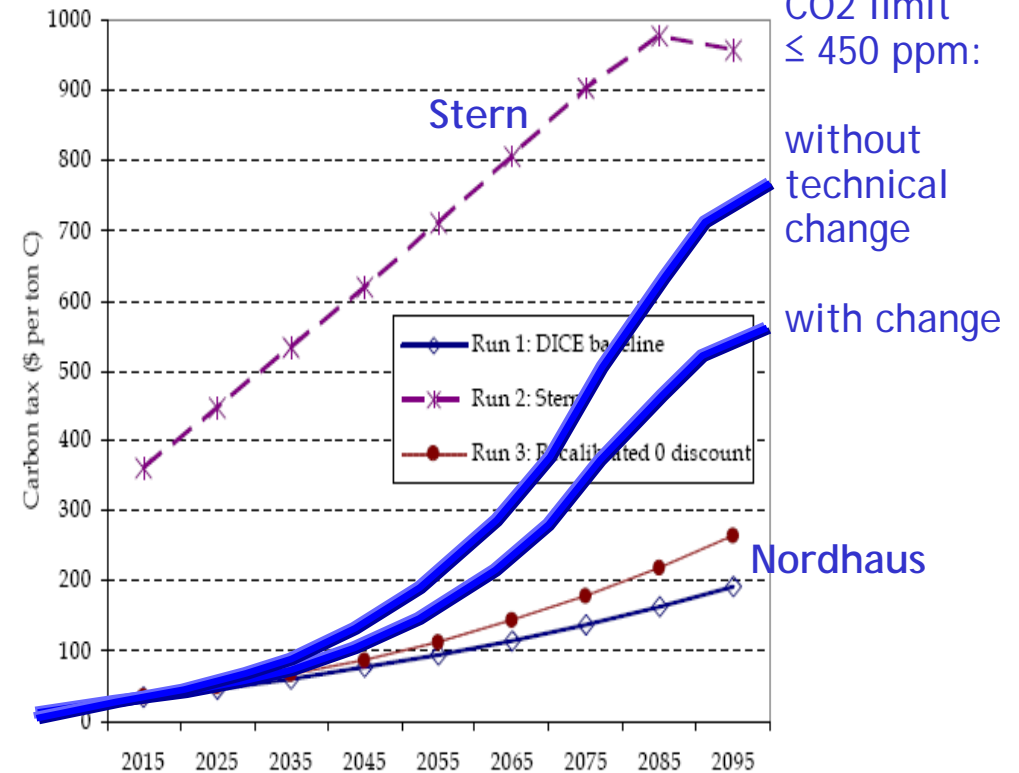
- For more information about the complex subject of inter-generational discount rates, see:
- Chapter 6 of the Stern Review: http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/stern_review_report.cfm
- A critique of the Stern Review on William Nordhaus' website http://nordhaus.econ.yale.edu/stern_050307.pdf
- Martin Wolf's Economic Forum published by the FT: http://blogs.ft.com/wolfforum/2007/02/in_spite_of_eco.html#comments

Emissions Trading & Carbon Footprints : Influence of Discount Rate on the Predicted Price of Carbon

Rate of Return on Capital
(% per Year)



Carbon Tax (\$ per ton C)



Predicted average price of permits - Edenhofer, et al. CO2 limit ≤ 450 ppm:

without technical change
with change

Source of graphs : The Stern Review on the Economics of Climate Change. William Nordhaus, May 2007 http://nordhaus.econ.yale.edu/stern_050307.pdf

Emissions Trading & Carbon Footprints : A Need for a Common Accounting Approach

ISSUES WITH EMISSIONS TRADING

Emissions Trading & Carbon Footprints :

Issues Associated with Emissions Trading (I)

- As currently designed and operated, the EU's emission trading scheme provides little or no incentive to invest in more carbon efficient facilities. Reasons include:
 - Organisations do not have to purchase allowances. This generates scope for speculative trading, tax planning and the passing on of costs to consumers.
 - Accounting effort is focussed on trading contingent liabilities, **not** return on investment.
 - The offset mechanism provides a 'soft' option. It overlooks the embodied carbon content of a project and encourages organisations to defer investment in lower carbon options.

Emissions Trading & Carbon Footprints :

Issues Associated with Emissions Trading (II)

- Other problems include:
 - Volatility of the market complicates the prediction of the long term price of carbon. In this respect, carbon taxes are to be preferred.
 - Who owns the carbon ? The commons, the member states, the EU or the market ?
 - The governments of member states will be unwilling to entrust the value or forego the revenue streams generated by an emissions trading scheme once the price of carbon starts to rise.
 - At what stage will the EU or its member states start to auction allowances ?

Emissions Trading & Carbon Footprints :

Issues Associated with Emissions Trading (III)

- The manual techniques currently used to record emissions are open to abuse and are really not suitable for use with a trading system. Values should be measured in real-time and to a fiscal standard.

Emissions Trading & Carbon Footprints : A Need for a Common Accounting Approach

CARBON RISK AND POTENTIAL LIABILITIES

Emissions Trading & Carbon Footprints :

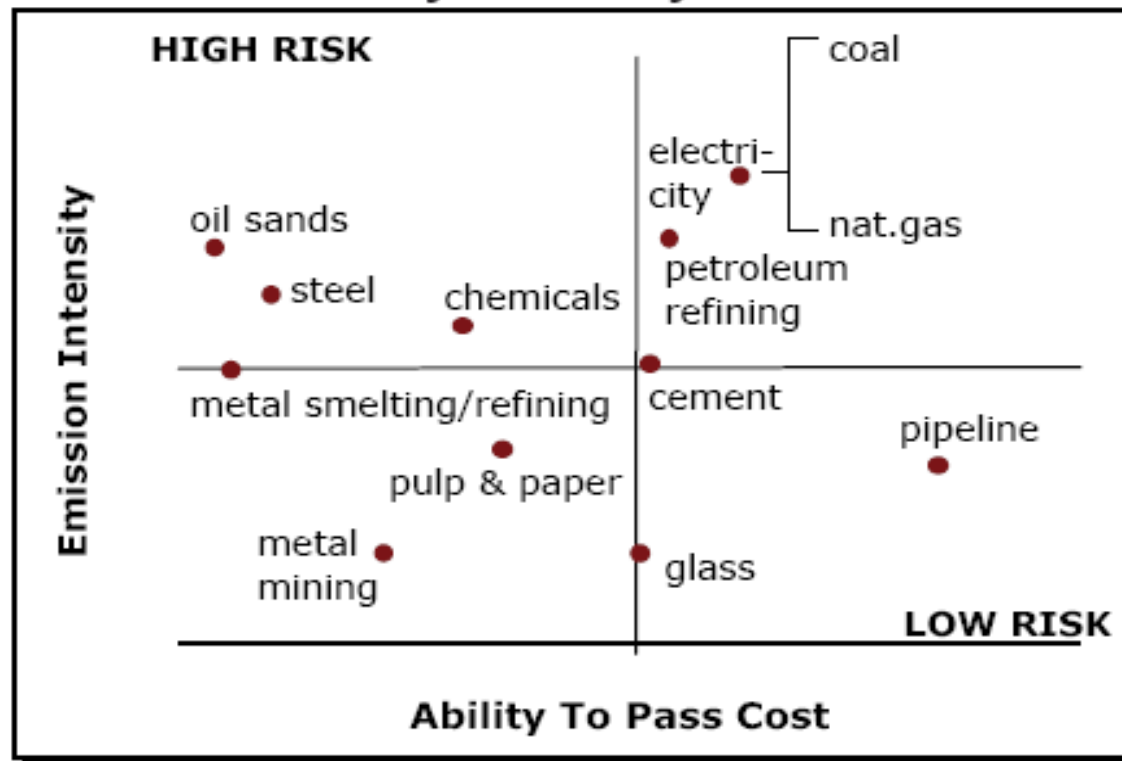
Carbon Risk and Potential Liabilities (I)

- Corporate owners of oil and gas production facilities need to identify the potential impact carbon liabilities will have on their balance sheet.
- Similar considerations may apply to owners wishing to externalise their carbon risks by contracting operating rights to duty holders.
- The risk premium associated with the financing of new oil and gas projects will rise as banks and other institutions become more aware of carbon footprints.
- The oil and gas industry and its agents may be increasingly exposed to legal / tort action by groups campaigning against the effects of global warming.

Emissions Trading & Carbon Footprints : Carbon Risk and Potential Liabilities (II)

Where would you place these on the graph ?

gas-to-liquids LNG sour gas EOR deepwater platform FPSO

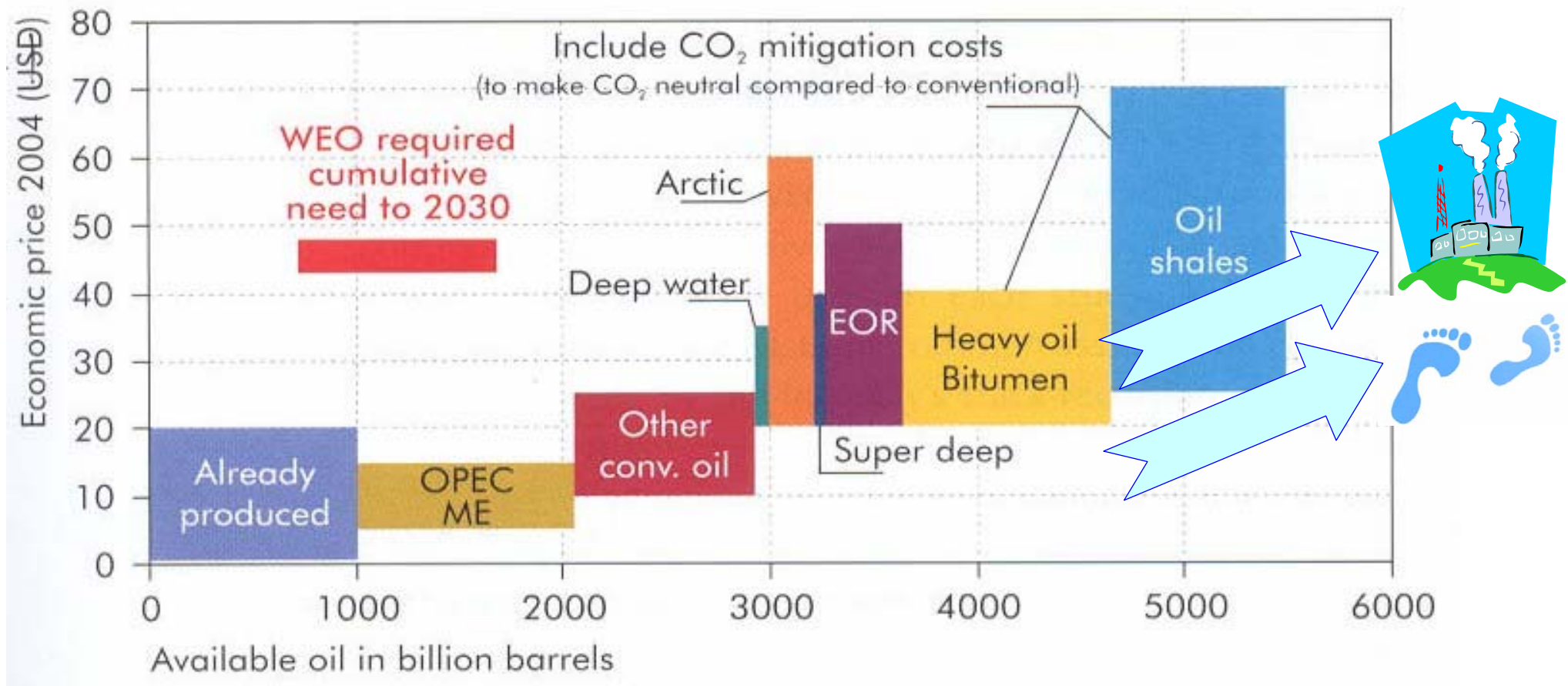


Emission Intensity:
kilotonnes CO2 per \$ of output

Source: Evaluating Carbon Risk in the Canadian Economy : Emission Intensity vs Ability to Pass Costs
CIBC World Markets, StrategEcon, Beyond Kyoto (Feb 13 2007),
<http://research.cibcwm.com/res/Eco/ArEcoMI.html>

Emissions Trading & Carbon Footprints : Development Horizon - the Upstream Energy Sector

- Rising emissions and increasingly larger carbon footprints:



Source : International Energy Authority, Resources to Reserves, 2005,
http://www.iea.org/Textbase/publications/free_new_Desc.asp?PUBS_ID=1568

Emissions Trading & Carbon Footprints: Carbon Risk and Potential Liabilities (III)

- Carbon risk is presently expressed in terms of the risk trading an intangible asset (the direct emission of carbon) poses to the marginal cost of production and the corresponding income stream.
- It is felt that such a definition should be examined to see if it should include the embodied carbon content of the assets organisations use to conduct their business.

Emissions Trading & Carbon Footprints : A Need for a Common Accounting Approach

SOME SUGGESTIONS FOR INVESTMENT DECISIONS

Emissions Trading & Carbon Footprints : Suggestions for Investment Decisions (I)

- Industry should discuss and reach a consensus in regard to a) the likely rates of return required of energy intensive processes and b) a future price for carbon. This will allow design houses to assess the cost benefit of processes with reduced carbon footprints.
- Historical rates of return on capital have been greater than 10%.
- What rates of return does industry consider acceptable on future projects? Will these be lower because the availability of raw materials (including fossil fuels) is reaching a point of exhaustion ? Or given a perception of greater uncertainty, will rates rise ?

Emissions Trading & Carbon Footprints : Suggestions for Investment Decisions (II)

- Suggested project discount rates:

2010→2035 <10%

2025→2050 5→7%

- Suggested price of carbon equivalents (emission allowances, carbon tax or purchase of offsets) to be added to operating costs:

2010→2020 \$50/tonne

2020→2030 \$100/tonne

2030→2050 \$200/tonne

Emissions Trading & Carbon Footprints : A Need for a Common Accounting Approach

CONCLUSIONS

Emissions Trading & Carbon Footprints: Conclusions

- The financial accounting community should see if it can develop a methodology to couple the embodied carbon or energy content of an asset to its book value.
- Industry should review and see if it can reach a consensus on rates of return and a price for carbon to be used on new energy intensive projects.
- The methodology of computing carbon footprints needs to be developed so that the life cycle costs of alternative processes can be compared.
- A program to ensure real time metering of emissions should be implemented for use with Phase III of the European Union's emissions trading scheme.